An Example of a Measure for Increased Confidence in Authentication

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In general, instruments used in international agreements pertaining to control of nuclear materials will have to be subject to measures to convince the interested parties that the instruments are constructed according to their specifications and are functioning exactly as intended. The broad ensemble of such measures is termed "authentication" for purposes of this demonstration. Various components of an authentication regime were presented during the demonstration and have been documented in companion papers to this paper.

During the day of the demonstration, one measure adopted to provide common ground for discussing authentication issues was the measurement of unclassified pieces of fissile material with the AMS/IB in its "open" mode, that is, with the AMS/IB able to display quantitative information regarding the fissile material. For these measurements to provide any confidence in the proper function of the AMS/IB, it is necessary to have (among other things) confidence that the unclassified fissile material itself had the advertised properties and characteristics. To this end, prior to the demonstration, representatives of the Russian Federation had suggested the value of performing measurements on the unclassified material using a Russian-supplied instrument. This suggestion proved unrealizable during the demonstration owing to the security posture that was imposed, but in recognition of the Russian idea, arrangements were made for a "placeholder" measurement in which standard (albeit US-supplied) nuclear instrumentation was used to display properties of the unclassified material, with the measurement performed by US personnel but controlled by Russian personnel. The idea was that, in an actual measurement regime under an international agreement, the placeholder would be replaced by a measurement performed either with an instrument supplied by the inspector (but never used to measure anything but unclassified material) or with a system jointly developed and maintained.

During the FMTTD demonstration, the placeholder measurement was performed with a conventional system for γ-ray spectrometry. This consisted of a high-purity germanium (HPGe) detector similar to those used in the AMS/IB; a commercial multichannel analyzer with the trade name DART™, shown in Fig. 1; and a laptop computer with a spectrum display and analysis package. Lead shielding was provided to reduce radiation exposure to personnel, to keep count rate in the HPGe detector down to an acceptable level, and also to afford the Russian observers the opportunity to vary the measurement conditions so that additional confidence could be gained in the measurement. The ZPPR plates used as authentication sources (q.v.) were exposed to this analysis system while the oxide sample was being measured with the AMS/IB, and Russian observers were able to observe the way the data came into the multichannel analyzer and to see for themselves the evidence that the ZPPR plates were as advertised.

A future development path to exploit a similar measurement system during the authentication phase might have these components:

- First, identify the authentication sources that would have to be measured, and confirm that their properties are not classified, so that both host and inspector can see the nuclear data obtained from them.
- Second, identify an inspector-supplied (or jointly built) instrument for the authentication measurement and obtain the necessary approvals for its use at a host facility (but not on sensitive items).
- Finally, develop the procedures governing use of such an independent instrument at the host facility, including measures to assure that it is *not* available for use when anything sensitive is being measured.

All three of these steps were taken in either literal or conceptual senses during the demonstration, and proved relatively simply realizable, apart from the inability to use a Russian-supplied measurement system (a problem resulting from the compressed time scale on which the demonstration was originally supposed to have been executed). Their application to a cooperative measurement regime, of course, would have to be negotiated along with the appropriate approvals and certifications. This, however, lay beyond the scope of the present demonstration.

Fig. 1. DART analyzer with laptop computer and analysis package.